

IN THE CLAIMS

1. (currently amended) An electric motor comprising:

a stator including a stator core, a first and second lamination stack, a flux tube extending therethrough, and windings on said stator core;

a rotor including a magnet and a hub having an inner surface, a magnet coupled to said hub inner surface, and a shaft received wherein a shaft is received in said stator core for rotation of said rotor relative to said stator about a longitudinal axis of said ~~shaft; and~~ shaft, and at least one of an inner surface and an outer surface of said magnet of said rotor is a non-uniform surface configured to create a non-uniform air-gap between said rotor and said stator; and

a housing adapted to support said stator and said rotor.
2. (withdrawn) An electric motor in accordance with Claim 1 wherein said rotor hub defining a cavity opening at one axial end of said hub and receiving a portion of said stator therein, said rotor shaft disposed at least partially within the cavity.
3. (withdrawn) An electric motor in accordance with Claim 1 wherein said magnet comprises a first ~~end, a~~ end and a second end, ~~and an inner surface~~ said magnet inner surface defining a bore extending between said first end and said second end such that a portion of said stator and said rotor shaft extend into the magnet ~~bore; said magnet further comprising an outer surface.~~ bore.
4. (withdrawn) An electric motor in accordance with Claim 3 wherein said magnet inner surface comprises a plurality of projections extending between said magnet first and second ends.
5. (withdrawn) An electric motor in accordance with Claim 3 wherein said magnet inner surface comprises a plurality of notches extending between said magnet first and second ends.

6. (withdrawn) An electric motor in accordance with Claim 3 wherein said magnet inner surface comprises a plurality of serrations extending between said magnet first and second ends.

7. (withdrawn) An electric motor in accordance with Claim 3 wherein said magnet inner surface comprises a plurality of skewed serrations extending between said magnet first and second ends.

8. (withdrawn) An electric motor in accordance with Claim 3 wherein said magnet outer surface comprises a plurality of serrations extending between said magnet first and second ends.

9. (original) An electric motor in accordance with Claim 1 wherein said stator core and winding are substantially encapsulated in a thermoplastic encapsulation material formed with a generally annular skirt projecting radially outwardly from said encapsulated stator core, said skirt in close proximity with said rotor to define an exterior rotor/stator junction, said skirt having a beveled edge for deflecting water away from said junction thereby to inhibit entry of water between said rotor and stator.

10. (original) An electric motor in accordance with Claim 1 further comprising a printed circuit board having an electrical connection to said winding and free of other connection to said stator, said printed circuit board having an interference fit with said housing and free of other connection to said housing.

11. (currently amended) ~~An electric motor in accordance with Claim 1 wherein each said lamination stack comprising a plurality of laminations configured to be stacked together, each said lamination comprising:~~

a stator including a stator core, a first and second lamination stack, a flux tube extending therethrough, and windings on said stator core, wherein each said lamination stack includes a plurality of laminations configured to be stacked together, and each said lamination including:

a body having an outer edge;

a central opening extending through said lamination body and aligned with a stator core central opening;

a plurality of pole pieces extending axially from a lamination outer edge; and

a notch extending through said lamination body from the lamination body central opening to said lamination body out ~~edge~~edge;

a rotor including a hub having an inner surface, a magnet coupled to said hub inner surface, and a shaft received in said stator core for rotation of said rotor relative to said stator about a longitudinal axis of said shaft; and

a housing adapted to support said stator and said rotor.

12. (original) An electric motor in accordance with Claim 11 wherein said stator core includes ribs projecting radially inwardly toward the central opening of said stator core and engaging said pole pieces, said pole pieces shearing material from at least one of said ribs upon assembly of said pole pieces and a flux tube with said stator core so that said at least one rib has a reduced radial thickness.

13. (original) An electric motor in accordance with Claim 11 wherein each lamination body comprises four pole pieces, said pole pieces formed by bending each pole piece to an approximate right angle with respect to said lamination body after said lamination body is formed by stamping.

14. (original) An electric motor in accordance with Claim 1 wherein said stator further comprises a flux tube extending through said first lamination stack, said stator core, and said second lamination stack, said flux tube comprising a bronze bearing press fitted therein, a central bore configured to receive said rotor shaft extending therethrough, and a slit extending axially along said flux tube.

15. (original) An electric motor in accordance with Claim 1 further comprising a printed circuit board having programmable components adapted to control the operation of said motor, said printed circuit board positioned in said housing and having electrical contacts thereon, said housing having a port formed

therein and generally aligned with said contacts on said printed circuit board such that said contacts are accessible through said port for connection to a microprocessor.

16. (original) An electric motor in accordance with Claim 1 further comprising a printed circuit board electrically connected to said winding and disposed generally in said housing, said printed circuit board having a power contact mounted thereon for receiving electrical power for said winding, said housing formed with a plug receptacle for receiving a plug from an external electrical power source into connection with said power contact, said power contact positioned in said plug upon connection of said plug to said power contact, said housing including a plug locator for locating said plug relative to said power contact so that said contact is received only partially into said plug upon connection to said plug.

17. (withdrawn) An electric motor in accordance with Claim 1 wherein said motor comprises an efficiency between approximately 30% and 60%.

18. (withdrawn) An electric motor in accordance with Claim 1 wherein said motor comprises an efficiency between approximately 35% and 50%.

19. (withdrawn) An electric motor in accordance with Claim 1 wherein said motor comprises an efficiency of approximately 45%.

20. (withdrawn) An electric motor comprising:

a stator including a stator core, a first and second lamination stack, a flux tube extending through said first and second lamination stack, and a winding on said stator core; each said lamination stack comprising a plurality of laminations configured to be stacked together, each said lamination comprising a body having an outer edge, a central opening aligned with said stator core central opening and configured to receive said flux tube, a plurality of pole pieces extending axially from said lamination outer edge, and a notch extending through said lamination body from said lamination body central opening to said lamination body out edge;

a rotor comprising a hub, an inner surface, a magnet coupled to said hub inner surface, and a shaft received in said stator core for rotation of said rotor relative to said stator about a longitudinal axis of said shaft; and

a housing adapted to support said stator and said rotor.

21. (withdrawn) An electric motor in accordance with Claim 20 wherein said magnet comprises a first end, a second end, and an inner surface defining a bore extending between said first end and said second end such that a portion of said stator and said rotor shaft extend through said magnet bore.

22. (withdrawn) An electric motor in accordance with ~~Claim 20~~Claim 21 wherein said magnet inner surface comprises at least one of a plurality of projections extending between said magnet first and said magnet second end, a plurality of notches extending between said magnet first end and said magnet second end, a plurality of serrations extending between said magnet first end and said magnet second end and a plurality of skewed serrations extending between said magnet first end and said magnet second end.

23. (withdrawn) An electric motor in accordance with Claim 20 wherein said magnet outer surface comprises a plurality of serrations extending between said magnet first end and said magnet second end.

24. (withdrawn) An electric motor in accordance with Claim 20 wherein said motor comprises an efficiency between approximately 30% and 60%.

25. (withdrawn) An electric motor in accordance with Claim 20 wherein said motor comprises an efficiency between approximately 35% and 50%.

26-33. (canceled)

Remarks

Claims 1-25 are now pending in this application. Claims 2-8 and 17-33 are withdrawn. Claims 1, 9, 10, and 14-16 are rejected. Claims 11-13 are objected to. Claims 1, 3, 11, and 22 have been amended. No new matter has been added.

In accordance with 37 C.F.R. 1.136(a), a two-month extension of time is submitted herewith to extend the due date of the response to the Office Action dated October 24, 2003 for the above-identified patent application from January 24, 2004 through and including March 24, 2004. In accordance with 37 C.F.R. 1.17(a)(2),

authorization to charge a deposit account in the amount of \$420.00 to cover this extension of time request also is submitted herewith.

Applicants acknowledge that the restriction requirement has been made final, and Applicants have cancelled Claims 26-33 which were withdrawn from prosecution as a result of the restriction requirement.

Applicants respectfully submit that no examination is provided of Claims 20-25 even though Applicants elected with traverse Group I including Claims 1 and 9-16 and Group II including Claims 2-8 and 17-25 and even though Claims 20-25 do not depend on Claim 1. Accordingly, Applicants respectfully request an examination of Claims 20-25.

The rejection of Claims 1, 10, and 15 under 35 U.S.C. § 103(a) as being unpatentable over Miyazawa et al. (U.S. Patent No. 5,808,390) in view of Horng et al. (U.S. Patent No. 6,441,531) is respectfully traversed.

Miyazawa et al. describe a brushless DC motor (1), a rotor (2), a stator (10), a circuit unit (19), and a base plate (20) on which the motor is attached (column 11, lines 11-13). The rotor is formed in the shape of a cup, has a shaft (revolving shaft) (3) press-fitted at the center, and has a rotor magnet (permanent magnet) (5) adhered to be fixed to the inner periphery of a rotor yoke (4) (column 11, lines 14-17). The rotor magnet is formed in the shape of a ring, and has N and S poles magnetized alternately in the circumferential direction (column 11, lines 17-20).

Horng et al. describe a stator assembly that generally includes a bobbin (10), an upper pole plate assembly (11), and a lower pole plate assembly (12) (column 2, lines 20-23). The bobbin may be any conventional bobbin for all kinds of D.C. (direct current) brushless motors and heat-dissipating fans (column 2, lines 24-26).

Claim 1 recites an electric motor comprising “a stator including a stator core, a first and second lamination stack, a flux tube extending therethrough, and windings on said stator core; a rotor including a magnet and a hub having an inner surface, wherein a shaft is received in said stator core for rotation of said rotor relative to said stator about a longitudinal axis of said shaft, and at least one of an inner surface and an outer surface of said magnet of said rotor is a non-uniform surface configured to create a

non-uniform air-gap between said rotor and said stator; and a housing adapted to support said stator and said rotor.”

Neither Miyazawa et al. nor Horng et al., considered alone or in combination, describe or suggest an electric motor as recited in Claim 1. Specifically, neither Miyazawa et al. nor Horng et al., considered alone or in combination, describe or suggest a rotor including a magnet and a hub having an inner surface, where a shaft is received in the stator core for rotation of the rotor relative to the stator about a longitudinal axis of the shaft, and at least one of an inner surface and an outer surface of the magnet of the rotor is a non-uniform surface configured to create a non-uniform air-gap between the rotor and the stator. Rather, Miyazawa et al. describe a rotor magnet adhered to be fixed to the inner periphery of a rotor yoke, formed in the shape of a ring, and having N and S poles magnetized alternately in the circumferential direction, and Horng et al. describe a stator assembly. Accordingly, neither Miyazawa et al. nor Horng et al., considered alone or in combination, describe or suggest a rotor including a magnet, where at least one of an inner surface and an outer surface of the magnet of the rotor is a non-uniform surface configured to create a non-uniform air-gap between the rotor and the stator. For the reasons set forth above, Claim 1 is submitted to be patentable over Miyazawa et al. in view of Horng et al.

Claims 10 and 15 depend, directly or indirectly, from independent Claim 1. When the recitations of Claims 10 and 15 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 10 and 15 likewise are patentable over Miyazawa et al. in view of Horng et al.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 1, 10, and 15 be withdrawn.

The rejection of Claims 9 and 16 under 35 U.S.C. § 103(a) as being unpatentable over Miyazawa et al., Horng et al., and further in view of Matsushita et al. (U.S. Patent No. 4,841,190) and Lace (U.S. Patent No. 4,074,157) is respectfully traversed.

Miyazawa et al. and Horng et al. are described above. Matsushita et al. describe a rotor (2) that is mounted inside a stator (1) (column 5, lines 5-6). The rotor

includes a cylindrical permanent magnet (51) through which a rotor shaft extends (column 5, lines 6-8). The shaft is joined to the magnet with resin or an aluminum ring (53) (column 5, lines 8-9).

Lace describes a rotor assembly (12A) that includes a cylindrical permanent magnet (45) mounted on the rim of a mounting washer (44) that is staked or otherwise securely fasten to a drive shaft (142) at a shoulder (43) (column 5, lines 58-64). The end of the drive shaft extending outwardly from a shoulder (43) is provided with a socket (49) into which a drive tang (48) is fitted (column 5, lines 64-66).

Claims 9 and 16 depend from independent Claim 1 which recites an electric motor comprising “a stator including a stator core, a first and second lamination stack, a flux tube extending therethrough, and windings on said stator core; a rotor including a magnet and a hub having an inner surface, wherein a shaft is received in said stator core for rotation of said rotor relative to said stator about a longitudinal axis of said shaft, and at least one of an inner surface and an outer surface of said magnet of said rotor is a non-uniform surface configured to create a non-uniform air-gap between said rotor and said stator; and a housing adapted to support said stator and said rotor.”

None of Miyazawa et al., Horng et al., Matsushita et al., or Lace, considered alone or in combination, describe or suggest an electric motor as recited in Claim 1. Specifically, none of Miyazawa et al., Horng et al., Matsushita et al., or Lace, considered alone or in combination, describe or suggest a rotor including a magnet and a hub having an inner surface, where a shaft is received in the stator core for rotation of the rotor relative to the stator about a longitudinal axis of the shaft, and at least one of an inner surface and an outer surface of the magnet of the rotor is a non-uniform surface configured to create a non-uniform air-gap between the rotor and the stator. Rather, Miyazawa et al. describe a rotor magnet adhered to be fixed to the inner periphery of a rotor yoke, formed in the shape of a ring, and having N and S poles magnetized alternately in the circumferential direction, Horng et al. describe a stator assembly, Matsushita et al. describe a cylindrical permanent magnet through which a rotor shaft extends and joined to the shaft with resin or an aluminum ring, and Lace describes a cylindrical permanent magnet mounted on the rim of a mounting washer. Accordingly, none of Miyazawa et al., Horng et al., Matsushita et al., or Lace, considered alone or in combination, describe or suggest a rotor including a

magnet, where at least one of an inner surface and an outer surface of the magnet of the rotor is a non-uniform surface configured to create a non-uniform air-gap between the rotor and the stator. For the reasons set forth above, Claim 1 is submitted to be patentable over Miyazawa et al., Horng et al, and further in view of Matsushita et al. and Lace.

When the recitations of Claims 9 and 16 are considered in combination with the recitations of Claim 1, Applicants submit that Claims 9 and 16 likewise are patentable over Miyazawa et al., Horng et al, and further in view of Matsushita et al. and Lace.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 9 and 16 be withdrawn.

The rejection of Claim 14 under 35 U.S.C. § 103(a) as being unpatentable over Miyazawa et al., Horng et al., Matsushita et al., and Lace and further in view of Spring et al. (U.S. Patent No. 3,609,423) is respectfully traversed.

Miyazawa et al., Horng et al., Matsushita et al., and Lace are described above. Spring et al. describe a high-response stepping actuator that includes a motor frame (10) having in coaxial relation therein a circular series of oppositely disposed stator poles (12), a tubular flextube (no teeth) or alternatively, as hereafter referred to, a flexspine (14) having splines (16), a reaction or circular spline (18) anchored to the stator, and an output shaft (20) journaled in the frame and coupled to the rotatable flexspine (column 2, lines 19-27).

Claim 14 depends from independent Claim 1 which recites an electric motor comprising “a stator including a stator core, a first and second lamination stack, a flux tube extending therethrough, and windings on said stator core; a rotor including a magnet and a hub having an inner surface, wherein a shaft is received in said stator core for rotation of said rotor relative to said stator about a longitudinal axis of said shaft, and at least one of an inner surface and an outer surface of said magnet of said rotor is a non-uniform surface configured to create a non-uniform air-gap between said rotor and said stator; and a housing adapted to support said stator and said rotor.”

None of Miyazawa et al., Horng et al., Matsushita et al., Lace, or Spring et al., considered alone or in combination, describe or suggest an electric motor as recited in Claim 1. Specifically, none of Miyazawa et al., Horng et al., Matsushita et al., Lace, or Spring et al., considered alone or in combination, describe or suggest a rotor including a magnet and a hub having an inner surface, where a shaft is received in the stator core for rotation of the rotor relative to the stator about a longitudinal axis of the shaft, and at least one of an inner surface and an outer surface of the magnet of the rotor is a non-uniform surface configured to create a non-uniform air-gap between the rotor and the stator. Rather, Miyazawa et al. describe a rotor magnet adhered to be fixed to the inner periphery of a rotor yoke, formed in the shape of a ring, and having N and S poles magnetized alternately in the circumferential direction, Horng et al. describe a stator assembly, Matsushita et al. describe a cylindrical permanent magnet through which a rotor shaft extends and joined to the shaft with resin or an aluminum ring, and Lace describes a cylindrical permanent magnet mounted on the rim of a mounting washer. Spring et al. describe a high-response stepping actuator that includes a motor frame having in coaxial relation therein a circular series of oppositely disposed stator poles, a flexspine having splines, a reaction or circular spline anchored to the stator, and an output shaft journaled in the frame and coupled to the rotatable flexspine. Accordingly, none of Miyazawa et al., Horng et al., Matsushita et al., Lace, or Spring et al., considered alone or in combination, describe or suggest a rotor including a magnet, where at least one of an inner surface and an outer surface of the magnet of the rotor is a non-uniform surface configured to create a non-uniform air-gap between the rotor and the stator. For the reasons set forth above, Claim 1 is submitted to be patentable over Miyazawa et al., Horng et al., Matsushita et al. and Lace and further in view of Spring et al.

When the recitations of Claim 14 are considered in combination with the recitations of Claim 1, Applicants submit that Claim 14 likewise is patentable over Miyazawa et al., Horng et al., Matsushita et al. and Lace and further in view of Spring et al.

Moreover, Applicants respectfully submit that the Section 103 rejections of Claims 1, 9, 10, 14, 15, and 16 are not proper rejections. As is well established, obviousness cannot be established by combining the teachings of the cited art to

produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. None of Miyazawa et al., Horng et al, Matsushita et al., Lace, or Spring et al., considered alone or in combination, describe or suggest the claimed combination. Furthermore, in contrast to the assertion within the Office Action, Applicants respectfully submit that it would not be obvious to one skilled in the art to combine Miyazawa et al. with Horng et al, Matsushita et al. Lace or Spring et al. because there is no motivation to combine the references suggested in the art.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. *Ex parte Levengood*, 28 U.S.P.Q.2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP 2143.01. Rather, there must be some suggestion, outside of Applicants' disclosure, in the prior art to combine such references, and a reasonable expectation of success must be both found in the prior art, and not based on Applicants' disclosure. *In re Vaeck*, 20 U.S.P.Q.2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion or motivation to combine the prior art disclosures, nor any reasonable expectation of success has been shown.

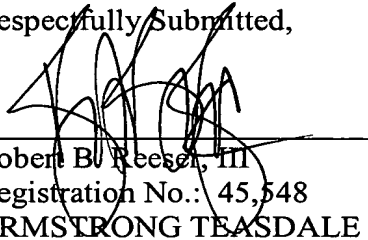
Furthermore, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. Further, it is impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejections are based on a combination of teachings selected from multiple patents in an attempt to arrive at the claimed invention. Specifically, Miyazawa et al. teach a rotor magnet adhered to be fixed to the inner periphery of a rotor yoke, formed in the shape of a ring, and having N and S poles magnetized alternately in the circumferential direction, Horng et al. teach a stator assembly, Matsushita et al. teach a cylindrical permanent magnet through which a rotor shaft extends and joined to the shaft with resin or an aluminum ring, and Lace teaches a cylindrical permanent magnet mounted on the rim of a mounting washer. Spring et al. teaches a high-response stepping actuator that

includes a motor frame having in coaxial relation therein a circular series of oppositely disposed stator poles, a flexspine having splines, a reaction or circular spline anchored to the stator, and an output shaft journaled in the frame and coupled to the rotatable flexspine. Since there is no teaching nor suggestion in the cited art for the combinations, the Section 103 rejections appear to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejections of Claims 1, 9, 10, 14, 15, and 16 be withdrawn.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejections of Claims 1, 9, 10, 14, 15, and 16 be withdrawn.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,



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